

Memoirs of the Department of Agriculture in India

No. 1. *HYDROPHILIDÆ OF INDIA (COL.)*

A LIST OF THE SPECIES IN THE COLLECTION OF THE
AGRICULTURAL RESEARCH INSTITUTE AT PUSA
(BIHAR)

BY

A. d'ORCHY MONT

No. 2. AN ANNOTATED LIST OF ICHNEUMONIDÆ
IN THE PUSA COLLECTION

BY

G. R. DUTT, B.A.

Personal Assistant to the Imperial Entomologist

No. 3. A SECOND NOTE ON ODONATA IN THE
PUSA COLLECTION

BY

MAJOR F. C. FRASER, I.M.S.



AGRICULTURAL RESEARCH INSTITUTE, PUSA

PRINTED AND PUBLISHED FOR

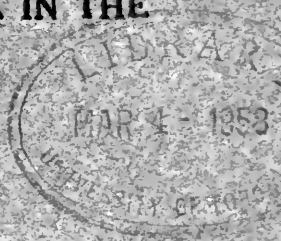
THE IMPERIAL DEPARTMENT OF AGRICULTURE IN INDIA

BY

THACKER, SPINK & CO., CALCUTTA

W. THACKER & CO., 2, CREED LANE, LONDON

Price, Rs. 1 or 1s. 6d.



EDITED BY

The Council of the Pusa Agricultural Research Institute which
is not, as a body, responsible for the opinions expressed in
the Memoir.

MEMOIRS OF THE
DEPARTMENT OF AGRICULTURE
IN INDIA

HYDROPHILIDÆ OF INDIA (COL.)

A LIST OF THE SPECIES IN THE COLLECTION OF THE
AGRICULTURAL RESEARCH INSTITUTE AT PUSA
(BIHAR)

BY

A. d'ORCHYMONT



AGRICULTURAL RESEARCH INSTITUTE, PUSA

PRINTED AND PUBLISHED FOR

THE IMPERIAL DEPARTMENT OF AGRICULTURE IN INDIA

THACKER, SPINK & CO., CALCUTTA

W, THACKER & CO., 2 CREED LANE, LONDON

Agents for the Sale of Government Publications

IN THE UNITED KINGDOM

Constable & Co., 10, Orange Street, Leicester Square, London, W.C.
Kegan Paul, Trench Trübner & Co., 68-74, Carter Lane, E.C., and 39, New Oxford Street, London, W.C.
Bernard Quaritch, 11, Grafton Street, New Bond Street, London, W.
P. S. King & Sons, 2 and 4, Great Smith Street, Westminster, London, S.W.
H. S. King & Co., 65, Cornhill, E.C., and Pall Mall, London, W.
Grindlay & Co., 54, Parliament Street, London, S.W.
T. Fisher Unwin, Ltd., 1, Adelphi Terrace, London, W.C.

W. Thacker & Co., 2, Creed Lane, London, E.C.
Luzac & Co., 46, Great Russell Street, London, W.C.
Wheldon & Wesley, Ltd., 28, Essex Street, London, W.C.
B. H. Blackwell, 50 and 51, Broad Street, Oxford.
Deighton, Bell & Co., Ltd., Cambridge.
Oliver & Boyd, Tweedale Court, Edinburgh.
E. Ponsonby, Ltd., 116, Grafton Street, Dublin.

ON THE CONTINENT

Ernest Leroux, 28, Rue Bonaparte, Paris.
Martinus Nijhoff, The Hague, Holland.

Otto Harrassowitz, Leipzig.
Friedlander and Sohn, Berlin.

IN INDIA AND CEYLON

Thacker, Spink & Co., Calcutta and Simla.

W. Newman & Co., Calcutta.

R. Cambray & Co., Calcutta.

S. K. Lahiri & Co., Calcutta.

B. Banerjee & Co., Calcutta.

The Indian School Supply Depot, 309, Bow Bazar Street, Calcutta, and 226, Nawabpur, Dacca.

Butterworth & Co. (India), Limited, Calcutta.

The Weldon Library, 18-5, Chowringhee Road, Calcutta.

Rai M. C. Sircar Bahadur and Sons, 75-1-1, Harrison Road, Calcutta.

Standard Literature Co., Ltd., Calcutta.

Lal Chand and Sons, Calcutta.

Association Press, Calcutta.

Higginbothams, Ltd., Madras.

V. Kalyanarama Iyer & Co., Madras.

G. A. Natesan & Co., Madras.

S. Murthy & Co., Madras.

Thompson & Co., Madras.

Temple & Co., Madras

P. R. Rama Iyer & Co., Madras.

Vas & Co., Madras.

E. M. Gopalkrishna Kone, Madras.

Thacker & Co., Ltd., Bombay.

D. B. Taraporevala, Son & Co., Bombay.

Radhabai Atmaram Sagoon, Bombay.

Sunder Pandurang, Bombay.

Gopal Narayan & Co., Bombay.

Ramchandra Govind & Son, Kalbadevi, Bombay.

Proprietor, New Kitabkhana, Poona.

The Standard Bookstall, Karachi.

Mangaldas Harkisandas, Surat.

Karsandas Narandas & Sons, Surat.

A. H. Wheeler & Co., Allahabad, Calcutta and Bombay.

N. B. Mathur, Superintendent, Nazir Kann-i-Hind Press, Allahabad.

Munshi Seeta Ram, Managing Proprietor,

Indian Army Book Depot, Juhi, Cawnpore.

Rama Krishana and Sons, Lahore.

Rai Sahib M. Gulab Singh & Sons, Mufid-i-Am Press, Lahore.

Superintendent, American Baptist Mission Press, Rangoon.

Manager the "Hitavada," Nagpur.

S. C. Talukdar, Proprietor, Students and Company, Cooch Behar.

A. M. & J. Ferguson, Colombo, Ceylon.

HYDROPHILIDÆ OF INDIA (COL.).

A LIST OF THE SPECIES IN THE COLLECTION OF THE
AGRICULTURAL RESEARCH INSTITUTE AT PUSA
(BIHAR).

BY

A. d'ORCHYMONT.

(Received for publication on 11th July 1922.)

MR. T. BAINBRIGGE FLETCHER, Imperial Entomologist to the Agricultural Research Institute of Pusa, has been kind enough to entrust to me the study of the *Palpicornia* contained in his collections and I am glad to be able to prepare this list.

Spercheinæ.

Spercheus gibbus, Champion (*Ento. Mo. Mag.*, LV, 1919, p. 238).

One male and two females were taken at light at Pusa. Besides these, I have seen twelve males and ten females taken at Calcutta (Eden Gardens) and one female from Dum-Dum near Calcutta, in the collections of the Indian Museum. All females have a flattened and smooth elevation towards the middle of elytral disc near the suture, and the sutural region is longitudinally sulcate on the apical declivity. Viewed laterally, the elytral surface also appears to be obsoletely quadricostate. The description of *S. gibbus* (type: one unique male) applies to the males examined; these are uniformly convex, without elevations or costæ. The females belong rather to *S. binodulus*, Champion (*l.c.*, p. 239). The latter name was proposed for a unique female from the Sunderbans. Judging from the material examined—types having not been accessible—I believe that the two names *gibbus* and *binodulus* apply to the two sexes of the same species. The first name has priority.

Sphæridiinæ.*Cælostoma stultum*, Walker.

Several specimens of this wide-spread species were submitted, taken at light, under bark or in water, at Pusa, Upper Burina, Janakpur (Nepal) and Chapra.

Cælostoma vitalisi, d'Orchymont.

One individual taken under ground at Pusa, on the 19th December 1919, (*T. Ram*). I have described this species as new in a paper devoted to the Fauna of Indo-China, not yet issued.

Dactylosternum hydrophiloides, M^cLeay.

Various specimens of this common form, taken at Pusa, Janakpur, Khasi Hills, Chapra, in plantain stem, rotten palm stem, under bark.

Mr. T. Bainbrigge Fletcher has also communicated three specimens of a new *Dactylosternum* belonging to a group of which no member has hitherto been described from Asia and which it would be easy to confound with *Cælostoma*, if only the upper surface were studied. This group indeed is conspicuous by the nearly entire or entire absence of elytral series and striæ; the sutural stria anteriorly shortened is only present and even this stria has a tendency to disappear (in *D. cælostomoides*, nov. sp.). Besides the specimens sent for examination I possess in my cabinet others of three very allied and still undescribed species. Two of these were recognized as new several years since. I take this opportunity to describe all four of them because they represent a phyletic association and they are explained the one by the other. Seen from the ventral side these *Dactylosternum* lose the coclostomoid appearance, for their depressed and less convex form, more planate underside, their tibiae—especially the posterior—more enlarged and flattened, their first abdominal segment well developed and carinate along its whole length, the conformation of the mesostital and metasternal carinæ, in a word, their ventral facies, belong to *Dactylosternum*. American species with vanishing elytral striæ are also known, but the striæ are far more conspicuous than is the case with these Indian forms. The following table will serve to distinguish them. All four have the prostital carina with a robust, conical, anterior tooth.

1. Elytra with some scarcely larger punctures, arranged in irregular and interrupted series obliquely directed towards the sides. Pronotum and head with dense and tolerably fine (not very fine) punctuation, the punctuation being nearly equal to that of

- elytra. Sutural stria well impressed. Underside of intermediate femora with some remote setigerous pores.....*D. indicum*. Elytra without series on the sides or they are very indistinct, the punctures being scarcely larger than those of the ground sculpture 2
2. Ground punctuation of head and pronotum very fine, much finer than the elytral punctuation, the punctures scarcely impressed, the shining of the surface not being diminished by them. Sutural stria well impressed; an attentive study of the upper surface of elytra reveals the presence on the sides of a few punctures scarcely larger than the surrounding ones and arranged in vanishing oblique very inconspicuous series. Underside of intermediate femora with the normal setiferous pores, reticulate in the ground of their external half, from base to apex and densely pubescent on this part *D. dachinabadense*. Ground punctuation of head and pronotum less fine. Elytra on the sides without the least trace of larger punctures arranged to form series. Seen from the above, beetle may be taken for a *Caelostoma*. 3
3. Intervals of elytral punctures shining, the punctures not reunited by very fine striolæ; extremity of elytra not having a reticulate appearance. Sutural stria very well impressed, longer than posterior half of elytra. Punctuation of elytra distinctly coarser, especially on the sides and behind. Additional pubescence of underside of intermediate femora not so dense and so extended as in the foregoing species *D. fletcheri*. Elytral punctures distinctly finer, reunited by fine striolæ giving on the surface a distinctly reticulate and scarcely shining appearance: this disposition is most amplified on the apical third of elytra. Sutural stria not well impressed, shortened and vanishing before reaching the anterior half of elytra. The whole underside of intermediate femora is reticulated and densely coated with a fine, down-lying pubescence, which does not conceal the ground (as is the case, for instance, with the pubescence of anterior femora) *D. caelostomoides*.

D. indicum, nov. sp.

Oblongo-ovale, supra nigrum, parum convexum, haud explanatum; antennarum clava laxè articulata; elytris haud reticulatis sat dense punctu-

latis, plus minusve seriato-punctatis, seriorum punctis aliquantum majoribus et fortius inpressis; prostito antice fortiter dentato; mesostiti parte elevata aream obcordiformem, latam, in medio longitudinaliter turgidam formante; metasterni parte elevata parce, irregulariter, remoteque punctulata; femoribus intermediis subtus haud reticulatis, punctis setigeris sat remotis instructis; tarsorum posteriorum articulo basali secundo tertioque simul sumptis longioribus; abdominis segmento basali longitudinaliter carinato.

Type: my cabinet, 5.5×3.5 mm., India: Shembaganur (Palnis; 6,000 feet). Of a tolerably depressed form, not very convex.

Head with a tolerably fine and close punctuation, intervals shining black, vertex behind the vertical suture (only visible as a transverse depression), finely reticulated. Y-sutures only visible as a linear depression. Labrum transverse, more or less rufescent, anteriorly widely and not very deeply sinuated. Maxillary palpi red, shortened, second joint the longest of all and thickened, third distinctly shorter than the second, fourth a little longer. Antennæ 9-jointed, the glabrous part (first six joints) red, the club laxly articulated, darkened and much longer than joints 2-6 taken together. Mentum shining black, widely and semicircularly impressed before with some, remote punctures behind.

Punctuation of pronotum comparable to that of head: same measures and distances of punctures. Intervals not reticulate, shining. Anterior angles of pronotum rounded, posterior more indicated. Pronotum bordered on the sides and before, all round the head, but not posteriorly even in the region of posterior angles.

Scutellum finely punctate. Elytra with ground punctuation evenly distributed, very comparable to that of pronotum; the elytral series are discernable on the sides, nevertheless they are interrupted in several places, and composed of punctures not very well impressed, scarcely twice as large as the surrounding ones and obliquely directed. Sutural stria longer than posterior half of elytra.

Mesostital process nearly as wide as long, bordered all round, the sides forming a curve, the middle not tectiform but reunited to the metasternum by a protuberance or apophyse: the whole looks like the extremity of a lance rather than an arrow-headlike structure. Metasternum not very thin between intermediate coxæ, more or less flattened in the middle behind and with some very remote and irregularly sown punctures. Posterior femora very wide, especially on the extremity where they are prolonged in a lamina covering base of tibia, coated like the intermediate ones with the ordinary

remote setigerous punctures. Tibiæ widened, underside with very fine and remote setigerous punctures. Tarsi normally long, not very short, first joint of posterior tarsus nearly as long as the three following taken together. First abdominal segment carinate. Dimensions : from 5 to 6 mm.

A very short series, captured with type, and a cotype in British Museum, from Kalupahani Estate, Haldummulla, Ceylon, 1904.

D. dachinabadense, nov. sp.

Ovale, sat late, supra nigrum, parum convexum, haud explanatum ; antennarum clava laxè articulata ; elytris haud reticulatis, sat dense tenuiterque punctulatis, indistinctissime seriato-punctatis, seniorum punctis vix vel indistincte majoribus et fortius impressis ; prostito antice fortiter dentato ; mesostiti parte elevata aream rhomboidalem, latam, in medio longitudinaliter turgidam formante ; metasterni parte elevata parce, irregulariter, remoteque punctulata ; femoribus intermediis subtus in partem reticulatis ; tarsorum posteriorum articulo basali secundo tertioque simul sumptis longioribus ; abdominis segmento basali longitudinaliter carinato.

Type : my cabinet, 6×4 mm., India, Trichinopoly.

Form a little wider than in the preceding.

Head with punctuation less close and very fine, intervals of punctures shining black, vertex finely reticulate. Sutures not conspicuous (less indicated in cotype than in type). Labrum, palpi and mentum as in preceding species.

Punctuation of pronotum equal to that of head, intervals not reticulate, very smooth and shining. Angles and borders as in preceding species.

Scutellum finely punctate. Ground punctuation of elytra very similar to that of the preceding species, the result being that this punctuation appears much less fine than that of pronotum. Serial punctures are practically absent, but here and there on the sides traces of them may be detected. Sutural stria longer than posterior half of elytra.

Mesostital process, metasternum, posterior femora, tibiæ, tarsi and first abdominal segment approximately equal to the corresponding parts of *D. indicum*. Intermediate femora with the ordinary remote setigerous punctures and with additional finer pubescence and reticulate surface on the exterior half from base to apex.

One cotype (British Museum), from S. India.

The species is so named because the two only specimens seen have been taken in South India, or Dachinabadas of ancient geographers.¹²

D. fletcheri, nov. sp.

D. indico affinis sed minore, elytris haud seriato-punctatis, elytrorum punctis majoribus et fortius impressis; femoribus intermediis subtus in partem vix reticulatis.

Type: Agricultural Research Institute, Pusa, 5×3.2 mm., India: Matheran, 2,500 feet, April 1908, (D. Nowroji coll.).

The facies of this form, seen from above, is entirely that of a *Cælostoma* and one would take it for a representative of that genus if one did not take care to examine the underside. *D. fletcheri* differs only from *indicum* by the characters summed up in the table. The punctuation of the elytra is conspicuously coarser on the sides and behind than is the case in *indicum* (the serial punctures being, of course, not taken into consideration).

Three specimens have been communicated. I have pleasure in dedicating the new species to Mr. Fletcher, Imperial Entomologist.

D. cælostomoides, nov. sp.

D. indico affinis sed elytris reticulatis, haud seriato-punctatis, mesosti parte elevata aream rhomboidalem in medio longitudinaliter plus minusve tectiformem formante; metasterni parte elevata sat dense et rugulose punctulata; femoribus intermediis subtus omnino reticulatis; tarsis brevioribus.

This species is the least akin to the three others.

The head is finely punctured and smooth in the intervals. The punctuation of the pronotum is of the same fineness but the punctures are scratched in a transverse direction, but not reunited. Upon the elytra the transverse scratches or striolæ reunite the neighbouring punctures, the result being the formation of a characteristic reticulation which is more and more conspicuous from the anterior portion posteriad. From the posterior third of the elytra to their apices, the intervals of the punctures are also microscopically chagrinate, giving to the surface a silky or nearly pruinose appearance. The mentum is more sinuate anteriorly than in the foregoing species. The mesostital process approaches more to the arrow-head form, being narrower, more tectiform in the middle, with the anterior point less acute and forming, seen from the side, a rounded angle. Middle of metasternum rugose and entirely covered with close punctuation, with the exception of the posterior part, which is smooth and provided with a shallow impression. Intermediate femora entirely reticulate, the posterior more attenuated near the tibix. Tarsi distinctly shortened with the yellow setæ longer and more flexible. Dimensions: from 5 to 5.5 mm.

A short series, captured with type and sent by M. Donckier de Donceel of Paris.

Spharidium quinque-maculatum, Fabricius.

Several specimens of this very common species taken at Pusa in cowdung, in the Khasi Hills, Chapra, Jorhat (Assam).

S. severini, d'Orchymont.

This species was described from Sumatra and was hitherto not known from India. One male at Nongpoh (Khasi Hills) (July 1907). The posterior left tibia has on its underside in the middle only one spine; the right one two.

Cercyon lineolatus, Motschulsky.

Only one example from Chapra, Bihar (*Mackenzie*). Described from Ceylon.

Hydrophilinæ

Paracynus evanescens, Sharp.

Two specimens found within nests of *Polyrachis simplex* enclosing Coccidæ on *Tamarix gallica* (accidentally?), 8th August 1909, at Pusa (F. H. O.; C. S. Misra).

Laccobius simulans, nov. sp.

L. sinuato affinis sed lubri speculis in mare subcircularibus, prefronte semper utrinque flavo-maculato, elytrorum seriebus sæpe alternatim subregularibus.

Type: my cabinet, 3.3 × 2.1 mm., Yunnan.

Head and labrum rather strongly and densely punctured, of dark black more or less purpurate and sometimes obscurely chagrinata in the intervals. Prefrons on each side with a clear spot before the transversal suture and eyes. Specula of labrum in male subcircular, only a trifle broader than long, rather small. Mentum with a rather rough and remote punctuation. Palpi and antennæ yellow.

Punctuation of pronotum rather strong, a little more remote than on the head, not chagrinata in the intervals. Disc with a spot of same colour as head, reaching the anterior and posterior borders, more or less carved out at the sides, the pronotum rather widely yellow laterally. Under a favourable exposition this spot (and also the head) seems of an olivaceous or reddish green and one can see in the ground (by transparency) 3 or 4 irregular darker little spots. The finer punctuation of the anterior and posterior borders of the

pronotum forms an irregular transverse series which runs at a little distance from these borders.

Elytra yellow, more or less darkened round the punctures, with an inconspicuous sutural spot behind the middle. Punctuation arranged in very obscure series, alternately more regular (primary series) and very irregular (interstitial secondary punctuation). When the dark colour does not follow the primary or secondary series, or when there are dark clouds (due to *post-mortem* chemical action) the punctuation may appear superficially as being disposed without order. Besides this there are nearly always (cotypes, less in the type specimen) some coarser punctures forming on the disc two very irregular systematic series.

Prostitum with a longitudinal carina ; mesostital carina with a little tooth anteriorly. Feet yellow, with the exception of anterior femora sometimes darkened on the base ; punctuation of femora (inferior part) not very dense, a little denser upon the intermediate ; the latter without the dense male pubescence of the base, known to occur in the male of *L. nigriceps*, Thomson.

Cotypes : 3 males from Pusa, 1 female Naini Tal, 6,500 feet (Agricultural Research Institute, Pusa).

2 males, 2 females from Kumaon, W. Himalayas, 4,490 feet (Indian Museum).

1 male, 2 females from Kurseong, E. Himalayas, 6,000 feet (Indian Museum).

2 males from Senchal waterworks near Ghoom, E. Himalayas, 7,000 feet (Indian Museum).

I have hesitated some time before describing this species as new. The specimens seen present nevertheless several characters by which they may be distinguished from *sinuatus*, Motschulsky, the form to which I was first inclined to refer the material examined. *L. sinuatus* is very common in the Mediterranean region and occurs as far as Sinai. The specimens, which I was able to compare, have the elytral punctuation more regular, without larger punctures, the prefrons without spots on the sides (Ganglbauer stated nevertheless that I had met with spotted individuals), the goggles* of labrum (male) are transverse and not subcircular, etc. *L. simulans* seems pretty well represented in Northern India, ascends the Himalayas to altitudes above 7,000 feet and probably takes there the place of *L. sinuatus*.

* The term "goggles" has been used by Sharp and Newbery for two apertures filled in with membrane which are found on the labrum in the males of some species of *Laccobius*, their appearance being that of a pair of spectacles.—[EDITOR.]

Helochaeres (Hydrobaticus) anchoralis, Sharp.

One specimen from Pusa and one from Chapra.

H. (Hydrobaticus) crenatus, Régimbart.

Several specimens, all from Pusa.

H. (Hydrobaticus) lentus, Sharp.

Two individuals captured at Jantepore (Nepal).

H. (s. str.) minutissimus, Kuwert.

Two specimens taken at Pusa.

Enochrus (Lumetus) japonicus, Sharp.

Five specimens from Pusa (*T. Ram*) are named after Sharp's description and comparison with specimens from Japan in my collection. These five specimens are more or less immature and deformed; they seem therefore still of a broader size than is the case with the Japanese specimens. The mesostital process is also more robust and more laminate in the Indian individuals but I think this character to be subject to variation. A nearly related form from Fokien in my collection has the mesostital process very reduced. *Philydrus iteratus*, Sharp, from Ceylon must also be very akin but I am not acquainted with the species and material from Ceylon is not available.

E. (Methydrus) parvulus, Reich.

Several specimens, all from Pusa. Already cited from India by Régimbart in 1900.

E. (Methydrus) flavicans, Régimbart.

Two examples from Pusa, one of these having lost the pronotum and head.

Sternolophus (Neosternolophus) brachyacanthus, Régimbart.

Chapra; Pusa; Upper Burma.

S. (s. str.) rufipes, Fabricius.

Perhaps the most common species of Asia. Various localities: Pusa (Bihar), Chapra, Darbhanga, Igatpuri (Bombay), Jalardhar (Punjab), Manaparai (S. India), Burma.

S. (s. str.) decens, Zaitzev.

Pusa, May, 1909 (*R. D. D.*), two specimens.

Poona, Bombay, December, 1908 (*R. D. D.*). In water; four specimens.

Hitherto not known from India. Described from Persia and recorded by me from Muscat (Oman).

Hydrophilus vitalisi, d'Orchymont.

Several males and females from Pusa and one male and two females from Chapra.

Except the convexity which is more pronounced and the greater dimensions (19.17×8.9 mm.), I do not find differences by comparison with the unique type from Indo-China. Several individuals have the sides of the ventral segments spotted or washed with red (more or less pronounced maturity?).

Neohydrophilus spinicollis, Eschscholtz.

Pusa (one male and female), Yellapur (one male), Kasara (Bombay) (one male), Brahmaputra River above Jorhat; at light (one female).

The five specimens seen are not of a very wide, nor of a very narrow form. Spine of prostital carina more or less perpendicular (*elongatus*, Régimbart). For some time I have been inclined to consider *N. elongatus*, Rég., a mere variation or perhaps even a mere synonym of Eschscholtz's *spinicollis*. The old German author has described the prosternal carina "in medio emarginato, postice *hamato* . . . mit einem *ruckwärts gebogenen* starken Stachel versehen." This applies to a spine more or less hooklike, erected and then curved backwards. This is certainly not in accordance with Régimbart's interpretation: "épine prosternale longue et horizontale" (*Ann. Soc. Ent. Fr.*, LXXV, 1906, p. 260).

Hydrous senegalensis, Percheron.

One specimen in a ditch on grass, 19th October 1908 (*R. D. D.*). A rare African and also Indian species.

H. olivaceus, Fabricius.

Two females, taken at Surat (Bombay) and Asansol (Bengal).

H. hastatus, Herbst.

Two typical females taken in Burma. A third female at light at Pusa. The form of this latter is shorter and wider, identical with a male in my cabinet from Rangoon. The elytral series in these two last specimens are impressed as well.

H. temnopteroides d'Orchymont.

Besides the type and cotype studied in 1913, I have seen now a third specimen, also from Chapra, Bihar (*Mackenzie*), with the posterior elytral emargination less deep.

H. cashmirensis, Redtenbacher.

Two males from Halem (Assam) and Asansol (Bengal). Four females from Pusa and the Brahmaputra River.

H. rufo-cinctus, Bedel.

Also a rare species. One male and female at Pusa, at light, and one female from the Brahmaputra River (between Goalundo and Gauhati).

H. indicus, Bedel.

Three males and females from Pusa.

H. piceus, Linné.

Two males and one female from Gandarbal (Kashmir), 5,500 feet, September 1917 (Dutt).

Amphiops pedestris, Sharp.

Two specimens more or less immature of this very variable species, taken at Darbhanga (Bihar) on the 4th of January 1905 (Patel).

Berosus (Enoplurus) fairmairei, (Zaitzev), d'Orchymont.

Two males and one female captured at Pusa.

Described from Tonkin and recorded by me from Formosa and Laos (Annam). Hitherto not known from India.

B. (Enoplurus) indicus, Motschulsky.

Several males and females of this very common species : Pusa, Igatpuri, Chapra, Brahmaputra River.

B. (s. str.) pulchellus, M'Leay (1825).

(*B. decrescens*, Walker (1859); *B. pubescens* (Mulsant et Rey. 1859); *Hygrotrophus derisi*, Blackburn (1898).

Several specimens from Pusa and one from Kalyan (Bombay Pres.) .

This is a very wide-spread species, occurring from India to Australia, including the Philippines. I think that I am right in establishing the above synonyms. MacLeay's type was from Java, Walker's from Ceylon, and Mulsant's from the Philippines. Règimbart also was inclined to unite *decrescens* with *pubescens*. As for *Hygrotrophus derisi*, Blackburn, from Australia, I would not have been able even to guess about its identity, if Mr. Lea had not been kind enough to send me two examples named, the one by him, the other by Blackburn himself. The not well impressed elytral series and the silky pubescence of the elytra and pronotum explain why Blackburn had placed this *Berosus*, erroneously in my sense, near *Hygrotrophus nutans*.

B. (s. str.) aeneiceps, Motschulsky (1861).

(*B. immaculicollis*, Fairmaire (1892).

Pusa, several specimens; Chapra, two specimens; Bombay (Bassein Fort), one specimen.

The description of Motschulsky, forgotten since 1861, applies to these specimens. The material from the Russian author was from Ceylon (Nuwara Eliya Mountains). The species seems to me to have been redescribed by Fairmaire after individuals from Obock (Africa). At any rate the thirteen specimens examined agree closely with two *maculicollis* from Obock in my cabinet and received under this name from E. V. Bodemeyer.

The species is akin to *pulchellus*, belonging like this to a series, represented also in the centre of Africa, with very badly impressed elytral series, with intervals and pronotum coated with a silky pubescence, this pubescence lying down in the posterior direction and inserted in oblique pores. *B. aeneiceps* may be separated at once from *pulchellus* by the wider form and the pronotum entirely yellow, without metallic geminate spots. The elytral series, more or less darkened, are only more or less confluent by their dark colour. When, exceptionally, the punctures are not surrounded by infuscation the elytra seem to be uniformly and densely covered with setigerous pores, distributed evenly, but without order.

Règimbartia attenuata, Fabricius.

Pusa, Bankipur, Pergannas (Bengal). A very common and very widespread species.

February 1943

ENTOMOLOGICAL SERIES

Vol. VIII, No. 2

MEMOIRS OF THE DEPARTMENT OF AGRICULTURE IN INDIA

AN ANNOTATED LIST OF *ICHNEUMONIDÆ* IN THE PUSA COLLECTION

BY

G. R. DUTT, B.A.

Personal Assistant to the Imperial Entomologist



AGRICULTURAL RESEARCH INSTITUTE, PUSA

PRINTED AND PUBLISHED FOR
THE IMPERIAL DEPARTMENT OF AGRICULTURE IN INDIA

BY

THACKER, SPINK & CO., CALCUTTA

W. THACKER & CO., 2, CREED LANE, LONDON

AN ANNOTATED LIST OF ICHNEUMONIDÆ IN THE PUSA COLLECTION.

BY

G. R. DUTT, B.A.,

Personal Assistant to the Imperial Entomologist.

(Received for publication on 11th July 1922.)

THIS list is published with the chief object of showing to other workers on Ichneumonidæ what named species of this Family we possess in our collection and their habitat. Secondly, it shows which of the species are known to be parasitic on our crop pests and where and at what time of the year they are available. This information of course will be useful to those who wish to fight crop pests by introducing their insect enemies. Similar information has been furnished in the following previously published papers which should also be consulted in this connection :—

1. Dutt, "Hosts of some Indian Ichneumonidæ." Note No. 105, Second Hundred Notes, *Bull. No. 89. A. R. I., Pusa* (1919).
2. Ramakrishna Ayyar, "On the Insect Parasites of some Indian Crop pests," *Rep. Proc. Third Ent. Meeting*, pp. 931-936 (1920).
3. Ramakrishna Ayyar, "A list of Parasitic Hymenoptera of Economic importance from South India," *Rep. Proc. Fourth Ent. Meeting, Pusa*, pp. 363-367 (1921).

Thirdly, a large number of European species of Ichneumonidæ is recorded in this list for the first time from the Indian region, and this incidentally shows the presence of a strong Palæarctic element in the Ichneumonidæ of the Murree Hills, a station at an altitude of 7,500 feet in the Punjab, where these species were mainly collected.

Fourthly, two species in this list require special mention : *Cymodusa inclyta*, Morl., and *Cratichneumon (Lissichneumon) lævis*, Cam. ♀. The

former is a species new to science and of the latter, the male alone was described by Cameron in 1906, the female was unknown so far. Descriptions of the former and of the female of the latter were drawn up by Mr. Claude Morley and these are also included in this paper.

Pimplinæ.

Xylonomus, Grav.

cærulescens, Morl.

COORG : Sidapur, 3,000 feet, March 1917.

It is a large beautiful species of metallic blue colour, originally described from Ceylon. In Coorg Mr. Fletcher found this species hovering over coffee bushes, probably hunting for the grubs of *Xylotrechus quadripes*, Chevr. (Cerambycidæ), which is the well-known "White Borer" of the coffee planters. Members of this genus are well-known parasites of the larvæ of Longicorn Coleoptera.

Echthromorpha, Holmg.

notulatoria, Fb.

BIHAR : Pusa, May 1906, October 1907 (*G. R. Dutt*), November 1908 ; Chapra ; BENGAL : Buxa Duars, May 1907 (*D. Nowroji*) ; ASSAM : Gauhati, November 1918 (*Fletcher coll.*) ; COORG : Mercara, May 1914 (*Fletcher coll.*) ; Sidapur, March and May 1917.

Lissopimpla, Kriech.

albopicta, Wlk.

MADRAS : Naduvatum, Nilgiris, 7,000 feet, May 1904.

Xanthopimpla, Sauss.

(1) *immaculata*, Morl.

BIHAR : Pusa, August 1915 ; Chapra ; BENGAL : Dacca, January 1906 ; CENTRAL PROVINCES : Jubbalpur, February 1907 ; MADRAS : Coimbatore, April 1915 (*G. R. Dutt*) ; Palur, July 1907 (*Y. R. R.*).

In Eastern Bengal it has been bred from the caterpillars of *Unaphalocrocis medinalis*, Guen., which is a minor pest of paddy, sporadically rather serious ; and at Palur (Madrass) from the caterpillars of *Telicota augias*, Linn., which commonly feed on sugarcane leaves.

(2) *kriegeriana*, Cam.

BIHAR : Pusa, September 1915.

In September 1915, this species was bred from a pupa of *Sylepta derogata* (Pyralidæ) which is a minor pest of cotton and other *Malvaceæ*.

(3) *nursei*, Cam.

BIHAR : Pusa, March 1906, July 1915 ; Chapra, Baghownie, Laheria Sarai (*Inglis coll.*) ; ASSAM : Gauhati, May 1918 (*Fletcher coll.*) ; CENTRAL PROVINCES : Nagpur, August 1905 ; BOMBAY : Belgaum, April 1907, Poona, March 1917 (*G. R. Dutt*) ; MADRAS : Naduvatum, Nilgiris, 7,000 feet, May 1904.

This species has been found to be parasitic on *Chilo simplex*, Butl., in maize at Chapra and Nagpur and on *Phytometra (Plusia) orichalcea*, Fb., at Belgaum.

(4) *pedator*, F.

BIHAR : Pusa, October 1910 ; Ranchi, November 1906 ; BENGAL : January 1907 ; UNITED PROVINCES : Masuri, 7,000 feet, October 1906 ; CENTRAL PROVINCES : Nagpur, November 1906 ; MADRAS : Koilpatti.

At Pusa this species has been bred from a larva of *Chilo* sp.

(5) *punctata*, Fb.

PUNJAB : Lahore, August 1904 ; BIHAR : Pusa, October 1906, March 1907, October 1907 (*G. R. Dutt*), October 1915, December 1915, February 1916, November 1920 (*Fletcher coll.*), Chapra ; CENTRAL PROVINCES : Betul, October 1904, Raipur, August 1907 (*G. R. Dutt*), Bilaspur, August 1907 (*G. R. Dutt*), Nagpur, November 1915 ; MADRAS : July 1907 (*T.V.R.*) ; COORG : Pollibetta, November 1915 (*Fletcher coll.*) ; BOMBAY : Surat, January 1904.

This species has been bred from *Chilo simplex*, Butl., in *juar* stem at Lahore and Betul and from *Sphenoptera gossypii*, Kerr, at Nagpur.

(6) *regina*, Morl.

BIHAR : Chapra.

(7) *taprobanica*, Cam.

COORG : Pollibetta, November 1915 (*Fletcher coll.*).

Orientotheronia, Morl.

maculipes, Morl.

COORG : Sidapur, 3,000 feet, April 1917.

Pimpla, Fb.

(1) *appollyon*, Morl.

COORG ; MADRAS : Coonoor, Nilgiris, 4,000 feet, August 1917, Kodaikanal, Palnis, 7,000 feet, September 1921 (*Fletcher coll.*).

(2) *arctica*, Zett.

PUNJAB : Simla, 7,000 feet, October 1907, Murree, 7,500 feet, June 1918 (*G. R. Dutt*).

(3) *instigator*, Fb.

PUNJAB : Simla, 7,000 feet, October 1907 ; BIHAR : Pusa, April 1907, April 1914 ; Baghownie, Laheria Sarai (*Inglis coll.*) ; ASSAM : Shillong, 5,000 feet, October 1916 (*Fletcher coll.*) ; MADRAS : Coimbatore, April 1915 (*G. R. Dutt*).

(4) *instigator* var. *pæsia*, Cam.

ASSAM : Shillong, 5,000 feet, June 1918.

Tromatobia, Först.

ornata (g. *Pimpla*).

PUNJAB : Murree, 7,500 feet, June 1918 (*G. R. Dutt*).

It is a European species and occurs commonly throughout Britain, Sweden, Germany and Prussia. It is now recorded for the first time from the Indian region.

Apechtis, Först.

rufata (g. *Pimpla*).

PUNJAB : Murree, 7,500 feet, June 1918 (*G. R. Dutt*).

This is another European species which is now recorded for the first time from the Indian region.

Glypta, Grav.

(1) *evanescens*, Latr.

PUNJAB : Murree, 7,500 feet, June 1918 (*G. R. Dutt*).

This too is a European species and is being recorded for the first time from the Indian region.

(2) *nigrina*, Desv.

PUNJAB : Murree, 7,500 feet, June 1918 (*G. R. Dutt*).

Syzeuctus, Först.

(1) *annulipes*, Cam.

BIHAR : Pusa, December 1905, April 1914, December 1915 ; Chapra ; ASSAM : Shillong, 5,000 feet, October 1916 (*Fletcher coll.*)

(2) *zanthorius*, Cam.

BIHAR : Pusa, April 1907 (*G. R. Dutt*) ; Chapra.

Eponites, Cam.

ruficornis, Cam.

BIHAR : Pusa, March 1905, February 1906, March 1914 ; PUNJAB : Lyallpur, October 1921 (*G. R. Dutt*).

Tryphoninæ.

Metopius, Panz.

(1) *lar*, Morl.

BENGAL : Lebong, 5,000 feet, September 1908, June 1909

(2) *pulchripes*, Cam.

ASSAM : Khasi Hills, 1,000-3,000 feet, March 1907 ; BENGAL : Buxa Duars, December, 1917.

(3) *rufus*, Cam.

ASSAM : Margherita, May 1920 (*Fletcher coll.*).

Bassus, Flin.

(1) *clotho*, F.

CENTRAL PROVINCES : Nagpur, January 1905.

(2) *latatorius*, F.

PUNJAB : Gojra, October 1905 ; LYALLPUR, April 1908 (*G. R. Dutt*).

(3) *multicolor*, Grav.

BIHAR : Pusa, March 1906, March 1907, March 1908, March 1912, March 1919 (*G. R. Dutt*).

Polyclistus, Först.

appendiculatus, Cam.

PUNJAB : Murree, 7,500 feet, June 1918 (*G. R. Dutt*) ; MADRAS : Kodaikanal, Palnis, 7,000 feet, September 1921 (*Fletcher coll.*).

Hypocryptus, Först.

cingulator, Morl.

BIHAR : Pusa, March 1912, March 1920.

At Pusa this species has been bred on two occasions from larvæ of *Athalia proxima*, Kl. (Tenthredinidæ), which is usually a minor pest, sporadically bad, on cruciferous plants.

Megastylus, Schiöd.

cruentator, Sch.

PUNJAB : Murree, 7,500 feet, June 1918 (*G. R. Dutt*).

This is a European species which is found in Sweden, Denmark, Great Britain and Germany. It is being recorded from the Indian region for the first time.

Ophioninæ.

Paniscus, Schr.

(1) *lævis*, Cam. BIHAR : Chapra.

(2) *nigriventris*, Brullè.

(*ceylonicus*, Cam.).

BIHAR : Pusa, March 1907.

(3) *ocellaris*, Thoms.

N. W. & F. P : Peshawar, Taru, May 1916 (*Fletcher coll.*) ; BIHAR : Pusa, March 1906, April 1907, February 1912, March 1912, March 1916, Chapra ; BOMBAY : Nadiad, December 1906.

(4) *testaceus*, Grav.

BIHAR : Pusa, March 1905, June 1905, January 1906, February 1906, March 1906, March 1907, April 1907, March 1913, March 1914 ; BENGAL : Belgachia, near Calcutta, Dacca, January 1906.

Stauropodoctonus, Brauns.

orientalis, Morl.

ASSAM : Shillong, 5,000 feet, June-July 1918 (*Fletcher coll.*), August-October 1919 (*Fletcher coll.*) ; CENTRAL PROVINCES : Nagpur, April 1915.

Henicospilus, Steph.

(1) *atricornis*, Morl.

CENTRAL PROVINCES : Nagpur, September 1907, Balaghat, October 1907.

In the Central Provinces this species is parasitic on *Sylepta derogata*, Fb. which is a minor pest of cotton and other *Malvaceæ*.

(2) *flavicaput*, Morl.

BOMBAY : June 1904.

(3) *horsfieldi*, Cam.

BIHAR : Pusa, March 1905, December 1906 ; Chapra.

(4) *horsfieldi*, Cam. var. *glabratus*, Morl.

BIHAR : Chapra.

(5) *melanocarpus*, Cam.

BOMBAY : Igatpuri, July 1904.

(6) *merdarius*, Grav.

BIHAR : Pusa, March 1905, April 1905, April 1907, April 1916 ; Chapra ; CENTRAL PROVINCES : Nagpur, November 1905, December 1905, January 1906, April 1907, Balaghat, March 1907, Hoshangabad, April 1906 ; BOMBAY : Igatpuri, 2,000 feet, June 1904, Nadiad, January 1907 ; MADRAS : Saidapet, February 1907 (*T.V. R.*).

This species was bred at Saidapet in February 1907 from the larvæ of *Euproctis scintillans*, Wlk., which attacked mango trees.

Nototrachys, Marsh.

foliator, Fb.

BIHAR : Pusa, March 1906, June 1906, June 1911 (*Fletcher coll.*), March 1914, April 1914, Baghownie, Laheria Sarai (*Inglis coll.*).

Schizoloma, Wesm.

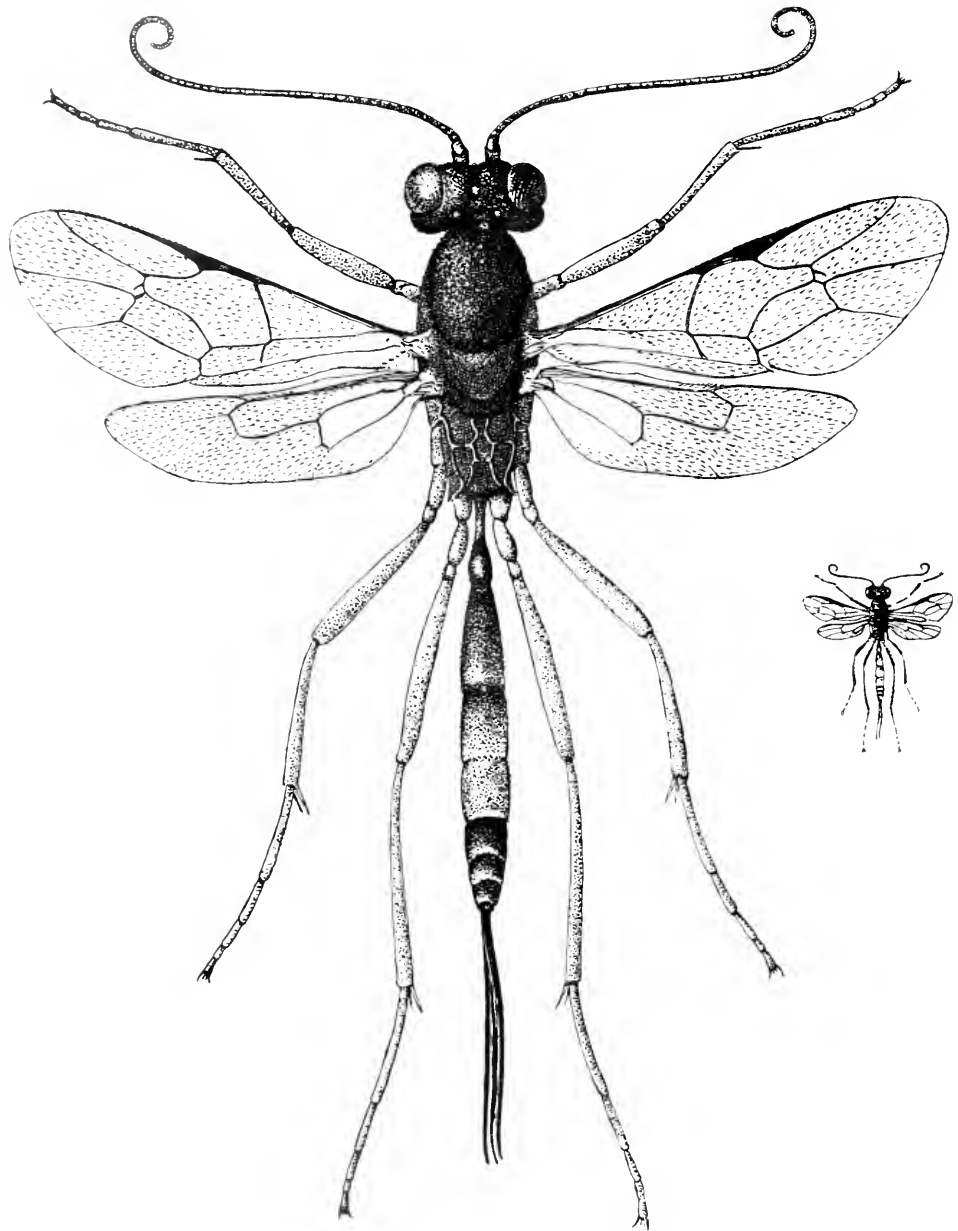
fulvicornis, Cam.

UNITED PROVINCES : Masuri, 7,000 feet, August 1906.

Heteropelma, Wesm.

calcator, Wesm.

ASSAM : Upper Shillong, 6,000 feet, September 1920 (*Fletcher coll.*).



CYMODUSA INCLYTA, MORL. ♀ × 10.
(The smaller figure shows $1\frac{1}{2}$ natural size.)

Exochilum, Wesm.

circumflexum, L.

PUNJAB : Simla, 7,000 feet, October 1907.

Barylypa, Först.

erythroceræ, Cam.

MADRAS : Sivaganga (T. V. R.)

Anomalon, Jur.

(1) *apicale*, Cam.

UNITED PROVINCES : Masuri, 7,000 feet, October 1906.

(2) *decorum*, Cam.

MADRAS : Coimbatore, May 1920.

Agrypon, Först.

anomelas, Grav.

PUNJAB : Murree, 7,500 feet, June 1918 (G. R. Dutt).

This is a European species ; recorded for the first time from the Indian region.

Trichomma, Wesm.

productor, Morl.

UNITED PROVINCES : Masuri, 7,000 feet, October 1906.

Cymodusa, Holmg.

antennator, Holmg., var. *flavipes*, Brisch.

PUNJAB : Murree, 7,500 feet, June 1918 (G. R. Dutt).

This again is a European species occurring in Germany and Spain. Genus *Cymodusa* was not represented so far by any species from the Indian region. Morley did not include this genus in his Fauna of India, Hymenoptera, Vol. III (1913).

inclyta, Morl.

BIHAR : Pusa, June 1916.

This is a new species which has been bred at Pusa from the caterpillars of *Melasma* sp. It has been described by Mr. Morley and his description is given below :—

Cymodusa inclyta, sp. nov. (Plate I.)

A large, dull, black species with the legs and centre of abdomen red ; tegulæ and centre of female flagellum white ; hind tibiæ not banded. Length, 10-11 mm. ♂, ♀.

Extremely like *C. antennator*, Holmg., except in colour : but much larger with the nervellus distinctly geniculate below its centre ; areola finely trans-striate ; petiolar area rugose and strongly trans-striate ; mandibles, palpi, underside of scape, anterior coxæ and their trochanters pale testaceous ;

female with the fifth to eighteenth flagellar joints white, at least above, and the third, second except basally and apical half of second abdominal segments red; male with segmental margins alone red; terebra apically reflexed and longer (3·5 mm.) than half the abdomen (6·5 mm.). Hind tibiæ and tarsi subinfusate.

Omorga, Thoms.

(1) *ensator*, Gr.

PUNJAB : Murree, 7,500 feet, June 1918 (*G. R. Dutt*).

Like the previous genus, this too was not represented so far by any Indian species. *O. ensator* occurs almost throughout Europe.

(2) *multicincta*, Gr.

UNITED PROVINCES : Cawnpore, March 1915.

This species has been bred from the larvæ of *Heliothis (Chloridea) armigera (obsoleta)*.

Charops, Holmg.

(1) *dominans*, Wlk.

BIHAR : Chapra ; Pusa, October 1905.

(2) *erythrogaster*, Ashm.

BIHAR : Pusa, October 1912 (*G. R. Dutt*).

This species has been bred at Pusa from the caterpillars of *Achæa janata*, Linn.

(3) *obtusus*, Morl.

MADRAS : February 1908.

Hymenobosmina, D. T.

pilosella, Cam.

BIHAR : Chapra ; Pusa, March 1907.

Campoplex, Grav.

novitius, Morl.

PUNJAB : Murree, 7,500 feet, June 1918 (*G. R. Dutt*).

Diocles, Först.

(1) *albicalcar*, Morl.

BIHAR : Pusa, April 1906, April 1907, March 1909 (*G. R. Dutt*).

This species is quite common at Pusa during the months of March and April and has been bred from the caterpillars of *Catochrysops cnejus* (Lycænidæ).

(2) *apostata*, Grav.

BIHAR : Pusa, April 1905.

(3) *argenteopilosa*, Cam.

CENTRAL PROVINCES : Nagpur, December 1905, January 1906, January 1907, October 1907.

This species has been bred at Nagpur from the larvæ of *Laphygma exigua*, Gr.

(4) *debilis*, Morl.

CENTRAL PROVINCES : Nagpur, November 1906.

This species has been bred from a larva of *Exelastis atomosa*, Wlsm. (Pterophoridæ).

(5) *vulgaris*, Morl.

BIHAR : Chapra ; Pusa, October 1907 (*G. R. Dutt*), July 1915 ; UNITED PROVINCES : Masuri, 7,000 feet, October 1906 ; N. W. F. PROVINCE : Taru, Peshawar, November 1914.

This species has been bred at Pusa from the larvæ of *Chilades lavus*, Cr. (Lycanidæ) and at Taru, near Peshawar, from the larvæ of *Buckleria defectalis* Wlk. (Pterophoridæ).

Limnerium, Ashm.

quettaense, Cam.

PUNJAB : Murree, 7,500 feet, June 1918 (*G. R. Dutt*).

Anilasta, Thoms.

clausa, Brisch.

PUNJAB : Murree, 7,500 feet, June 1918 (*G. R. Dutt*).

Angitia, Holmg.

fenestralis, Holmg.

PUNJAB : Lyallpur, April 1918.

This species has been bred from the larvæ of *Plutella maculipennis*, Curt.

Tarytia, Cam.

flavo-orbitalis, Cam.

BIHAR : Chapra ; Pusa, September 1905, August 1906, July 1907 (*G. R. Dutt*), November 1908, November, 1919.

This species has been bred at Pusa from the caterpillars of *Euzophera perticella*, Rag., *Antigastra catalaunalis*, Dup., *Leucinodes orbonalis*, Guen. (Pyralidæ) and *Argyroplotea paragramma* (Eucosmidæ).

Pristomerus, Curtis.

testaceus, Morl.

BIHAR : Chapra ; CENTRAL PROVINCES : Nagpur, July 1906 ; MADRAS : Attur, October 1906.

This species has been bred at Nagpur from a pupa of *Leucinodes orbonalis*, Guer., which usually attacks brinjal fruits and at Attur from a pupa of *Euzophora perticella*, Rag., which is a stem-borer of brinjal plants.
Mesochorus, Grav.

(1) *facialis*, Bridg.

BIHAR : Chapra; Pusa, April 1912, September 1916.

This species has been found to be parasitic on the larvæ of *Bocchoris artificialis*, Led., and *Pycnarmon caberalis*, Guen.

(2) *confusus*, Holmg.

ASSAM : Shillong, 5,000 feet, September 1917 (*Fletcher coll.*).

This species is recorded for the first time from the Indian region.

Edrisa, Cam.

pilicornis, Cam.

BIHAR : Pusa, August 1913 (*G. R. Dutt*).

In 1913 this species was bred in very large numbers from the cocoons of *Microplitis eusirus*, Lyle (Braconidæ) which in turn parasitizes the larvæ of *Achæa janata*, Linn. Nearly 72 per cent. of the cocoons of the *Microplitis* were found to be parasitized. This species has been figured in *Bull. No. 89. A. R. I.*; *Pusa* (1919), Fig. 1.

Cryptinæ.

Acroricnus, Ratz.

peronatus, Cam.

PUNJAB : Simla, 7,000 feet, October 1907.

Hadrocryptus, Cam.

(1) *postfurcalis*, Morl.

BOMBAY : Belgaum, 2,000 feet, April 1908.

(2) *triangularis*, Morl.

BIHAR : Chapra.

Plesiocryptus, Cam.

carinifrons, Cam.

PUNJAB : Murree, 7,500 feet, June 1918 (*G. R. Dutt*).

Cryptus, Fb.

obscurus, Grav. (= *orientalis*, Cam.).

PUNJAB : Simla, 7,000 feet, October 1907, Murree, 7,500 feet, June 1918 (*G. R. Dutt*).

Idiolispa, Först.

analis, Grav.

ASSAM : Khasi Hills, 1,000–3,000 feet.

Melcha, Cam.

(1) *fuscinervis*, Cam.

BIHAR : Chapra ; Pusa, February 1907 ; ASSAM : Khasi Hills, 1,000-3,000 feet, March 1907.

(2) *maculiceps*, Cam.

BIHAR : Chapra ; Pusa, April 1906, February 1916 ; BENGAL : Dacca, February 1906.

(3) *nursei*, Cam.

BIHAR : Chapra ; Pusa, December 1905, January 1906, July 1906 (*T. V. R.*), April 1907 (*G. R. Dutt*), May 1907, May 1911 (*G. R. Dutt*) ; UNITED PROVINCES : Cawnpur, February 1915 ; BOMBAY : Poona, December 1908 ; MADRAS : Coimbatore, July 1907 (*T. V. R.*).

This species has been bred at Cawnpur from the larvæ of *Phytometra orichalcea*, Fb., and at Pusa from a pupa (?) of *Earias fabia*, Stoll. (Noctuidæ).

(4) *ornatipennis*, Cam.

BIHAR : Chapra ; Pusa, March 1914, May, 1914, August 1914, March 1915 ; Baghownie, Laheria Sarai (*Inglis coll.*).

This species has been bred at Pusa from the larvæ of *Scirpophaga xanthogastrella*, Wlk. (*auriflua*, Z.).

Gotra, Cam.

(1) *carinifrons*, Cam.

MADRAS : Shevaroy's, 4,000 feet, August 1907.

(2) *longicornis*, Cam.

BIHAR : Pusa, November 1908, January 1917 (*G. R. Dutt*).

This species is parasitic on the Pompilid wasps *Pseudagenia blanda* (Guer.), and *P. clypeata*, Bingh.

Friona, Cam.

(1) *octobalteata*, Cam.

BIHAR : Chapra ; Pusa, October 1905.

(2) *rufipes*, Cam.

BENGAL : Buxa Duars, May 1907 (*D. N.*).

Budios, Cam.

rufipes, Cam.

BIHAR : Chapra ; Pusa, July 1906.

Mesostenoides, Ashm.

(1) *clarinervis*, Cam.

BIHAR : Chapra ; Pusa, January 1905, March 1905, May 1906, June 1906, March 1907, April 1907 (*G. R. Dutt*), June 1907, May 1914, December 1914, March 1915 ; BENGAL : Buxa Duars, May 1907 (*D. N.*).

(2) *maculiceps*, Cam.

BIHAR : Pusa, May 1905.

(3) *marginatus*, Brullé.

BIHAR : Pusa, January 1908.

Skeatia, Cam.

cyclosiæ, Cam.

CENTRAL PROVINCES : Nagpur, June 1905, April 1915 (*Fletcher coll.*).

Suvalta, Cam.

(1) *rufipes*, Cam.

MADRAS : Shoranore ; Malabar, July 1907 (*T. V. R.*).

(2) *rugifrons*, Cam.

BIHAR : Chapra ; CENTRAL PROVINCES : Nagpur, October 1906.

(3) *lævifrons*, Cam.

BOMBAY : Poona, April 1904.

Microcryptus, Thoms.

galactinus, Gr.

PUNJAB : Murree, 7,500 feet, June 1918 (*G. R. Dutt*).

Phygadeuon, Grav.

(1) *bitinctus*, Gmel.

PUNJAB : Simla, 7,000 feet, October 1907.

(2) *variabilis*, Grav. var. *indicus*, Morl.

PUNJAB : Murree, 7,500 feet, June 1918 (*G. R. Dutt*).

Cnemocryptus, Cam.

pullidicoxis, Morl.

ASSAM : Khasi Hills, 1,000-3,000 feet, March 1907.

Hemiteles, Grav.

fulvipes, Grav.

PUNJAB : Murree, 7,500 feet, June 1918 (*G. R. Dutt*).

This species occurs throughout Europe, but is now recorded for the first time from the Indian region.

Colganta, Cam.

fulvipennis, Cam.

UNITED PROVINCES : Masuri, 7,000 feet, October 1906, Ramgarh, Kumaon, 6,000 feet, August 1918 (*Fletcher coll.*); BENGAL : Lebong, 5,000 feet, October 1908.

Stictocryptus, Cam.

(1) *dentifrons*, Morl.

BIHAR : Chapra.

(2) *testaceus*, Cam.

BIHAR : Chapra ; MADRAS : Coimbatore, April 1915 (G. R. Dutt).

Comptolynæ.

striatus, Cam.

BIHAR : Chapra ; Pusa, January 1905, February 1905, December 1905, December 1906, December 1914, January 1915, September 1915, January 1916 ; BURMA : Mergui, December 1921.

Ichneumoninæ.

Aglaojoppa, Cam.

(1) *alecto*, Morl.

BIHAR : Chapra ; Pusa, December 1908.

This species is parasitic on *Parnara mathias*, Fb. (Hesperiadæ).

(2) *sathanas*, Morl.

BIHAR : Chapra.

Ischnojoppa, Kriechb.

luteolator, Fabr.

BIHAR : Pusa, September 1906, October 1906, December 1906 (G. R. Dutt).
March 1911, March 1915, September 1915, December 1915, January 1916,
Chapra, Bhagownie, Laheria Sarai (*Inglis coll.*) ; BOMBAY : Bassein Fort,
October 1909, March 1917 (G. R. Dutt) ; MADRAS : Coimbatore, February 1907
(Y. R. Rao), Samalkota, September 1907 (T. V. R.).

This species is parasitic on *Schoenobius bipunctifer*, Wlk., which occurs throughout India, Burma and Ceylon as a major pest of paddy.

Chiaglas, Cam.

variipes, Cam.

MADRAS : Naduvatum, Nilgiris, 7,000 feet, May 1904 ; PUNJAB : Murree, 7,500 feet, June 1918 (G. R. Dutt).

Acanthojoppa, Cam.

flavo-orbitalis, Cam. UNITED PROVINCES : Masuri, 7,000 feet, October 1906.

Holcojoppa, Cam.

fulvipennis, Cam.

ASSAM : Khasi Hills, Nongpoh, July 1907 (*D. Nowroji*).

lareiga, Cam.

(1) *alboannulata*, Cam.

PUNJAB : Simla, 7,000 feet, October 1907.

(2) *clotho*, Cam.

PUNJAB : Murree, 7,500 feet, June 1918 (G. R. Dutt).

(3) *rufa-femorata*, Cam.

ASSAM : Shillong, 4,900 feet June 1918 (Y. R. Rao).

Protichneumon, Thomson.

rufipes, Cam. (g. *Amblyjoppa*).

UNITED PROVINCES : Masuri, 7,000 feet, October 1906.

This species was assigned to the genus *Amblyjoppa* by Cameron, *vide* Zeit. Hym. Dipt., p. 179 (1903), but Morley has referred it to the above genus.

Colichneumon, Thomson.

microstictus, Grav.

PUNJAB : Murree, 7,500 feet, June 1918 (G. R. Dutt).

This is a European species and is being recorded for the first time from the Indian region.

Melanichneumon, Thomson.

Saturatorius, Linné.

PUNJAB : Murree, 7,500 feet, June 1918 (G. R. Dutt).

This is another European species which is now recorded from India.

Cratichneumon, Thomson.

(1) *coariger*, Morl. MS.

PUNJAB : Murree, 7,500 feet, June 1918 (G. R. Dutt).

(2) *lævis*, Cam. (g. *Lissichneumon*).

PUNJAB : Murree, 7,500 feet, June 1918 (G. R. Dutt).

Cameron created a new genus *Lissichneumon* for the reception of this species, *vide* "Entomologist" 1906, p. 227. Morley has referred it to the above genus. In the Pusa collection we possess two examples of the female of this species which does not appear to have been described before. Mr. Morley has described the female now and his description of it is given below :—

Cratichneumon (*Lissichneumon*) *lævis*, Cam., ♂.

"Female. Black with centre of flagellum alone white; mandibles, frontal orbits, scape beneath, femora, tibiæ throughout, calcaria and front tarsi red. The lack of sculpture is similar to the male, though here the metanotum is closely punctate with the parallel-sided areola smoother, longer than broad and apically truncate with no costulæ; hind coxæ nitidulous and sparsely punctate beneath, with large scopulæ. Both sexes are similar in outline to *C. fabricator*, Fab. Length, 9-12 mm. Female.

"Dutt captured eight males and three females in company at 7,500 feet about Murree on 18th June."

Barichneumon, Thomson.

(1) *coralis*, Cam.

UNITED PROVINCES : Masuri, 7,000 feet, October 1906 ; PUNJAB : Murree, 7,500 feet, June 1918 (*G. R. Dutt*).

(2) *solitarius*, Morl.

BIHAR : Chapra.

Fileanta, Cam.

(1) *balteata*, Cam.

PUNJAB : Akalgarh, March 1908 (*G. R. Dutt*).

(2) *rufo-cauda*, Cam.

MADRAS : Naduvatum, Nilgiris, 7,000 feet, May 1904.

Amblyteles, Wesm. (*Aehaius*, Cam.).

flarobalteatus, Cam.

PUNJAB : Simla, 7,000 feet, October 1907.

Platylabus, Wesm.

pedatorius, Fb.

PUNJAB : Murree, 7,500 feet, June 1918 (*G. R. Dutt*).

Diadromus, Wesm.

collaris, Grav.

BIHAR : Pusa, March 1911, March 1918, March 1920 ; PATNA, February 1906 ; PUNJAB : Murree, 7,500 feet, June 1918 (*G. R. Dutt*).

This species is met with throughout Europe and was originally referred to the genus *Thyrella*. Holmgren, by Gravenhorst who described it in *Ichn. Eur.*, p. 653 (1829). At Pusa it is very common in the month of March every year and has been bred here from the larvæ of the Diamond Back Moth (*Plutella maculipennis*, Curt.) which is a pest of cabbage, cauliflower, radish, mustard and other cruciferous plants.

Ischnus, Grav.

luteus, Morl.

BIHAR : Chapra ; ASSAM : Shillong, 5,000 feet, September 1917 (*Fletcher coll.*).

Mr. Fletcher bred this species from a pupa of *Platyptilia direptalis*, Wlk. The parasite emerged through an opening which it cut near the head end of the pupa.

MEMOIRS OF THE DEPARTMENT OF AGRICULTURE IN INDIA

A SECOND NOTE ON ODONATA IN THE PUSA COLLECTION

BY

MAJOR F. C. FRASER, I.M.S



AGRICULTURAL RESEARCH INSTITUTE, PUSA

PRINTED AND PUBLISHED FOR
THE IMPERIAL DEPARTMENT OF AGRICULTURE IN INDIA

BY

THACKER, SPINK & CO., CALCUTTA
W. THACKER & CO., 2, CREED LANE, LONDON

A SECOND NOTE ON ODONATA IN THE PUSA COLLECTION.

BY

MAJOR F. C. FRASER, I.M.S.

(Received for publication on 18th July 1922.)

EXUVIA OF *Orogomphus atkinsoni*, SELYS.

A LARGE number "from rocks in hill streams" Kurseong, Sikkim 5,000 ft., coll. T. Bainbrigge Fletcher, 18th-30th April 1922.

Total length 34 mm. Length of abdomen 25 mm. Breadth of abdomen 8 mm. Length of hind femur 7 mm.

General appearance that of an *Æshnine*.

Head broad, as broad as thorax, quadrate, surface finely shagreened with minute coral-like papillæ, sides behind eyes rounded and beset with small spines; eyes prominent, rather small, situated at forward lateral angles of head, projecting somewhat upward: frons broadly laminated and projecting forward over the mask; antennæ filiform, pedicel short as is also the 2nd segment, 3rd and 4th of the same length and shorter than the 5th.

Mask somewhat resembling that of *Azuma cyanocephala*, elongate distinctly cupped, extending behind the second pair of legs; lateral lobes broadly triangular, inner border deeply indented and furnished with a row of formidable teeth to the number of 12 to 14 (teeth somewhat variable but the general arrangement is in groups of three with sets of two between); moveable hook reduced, slightly arcuate, scarcely distinguishable from rest of teeth. Lateral lobes finely spined on the outer border where there are also 4 setæ. Middle lobe deeply cleft into two blunt processes which project forward beyond the border of lobe, latter fringed finely with stiff vibrissæ.

Legs rather short, stout, very hairy along the borders; femora and tibiæ laterally flattened, finely spined along the borders.

Thorax robust, subcylindrical. Wing cases divaricate.

Abdomen fusiform, elongate, cylindrical, widening as far as segment 5 and then tapering somewhat rapidly to a point, posterior border of each segment fringed with a row of closely-set vibrissæ, laterally and beneath fringed with rather long coarse hair.

General colouring light grey but some specimens are darker than others and diffusely striped or mottled with darker grey.

All specimens received are males.

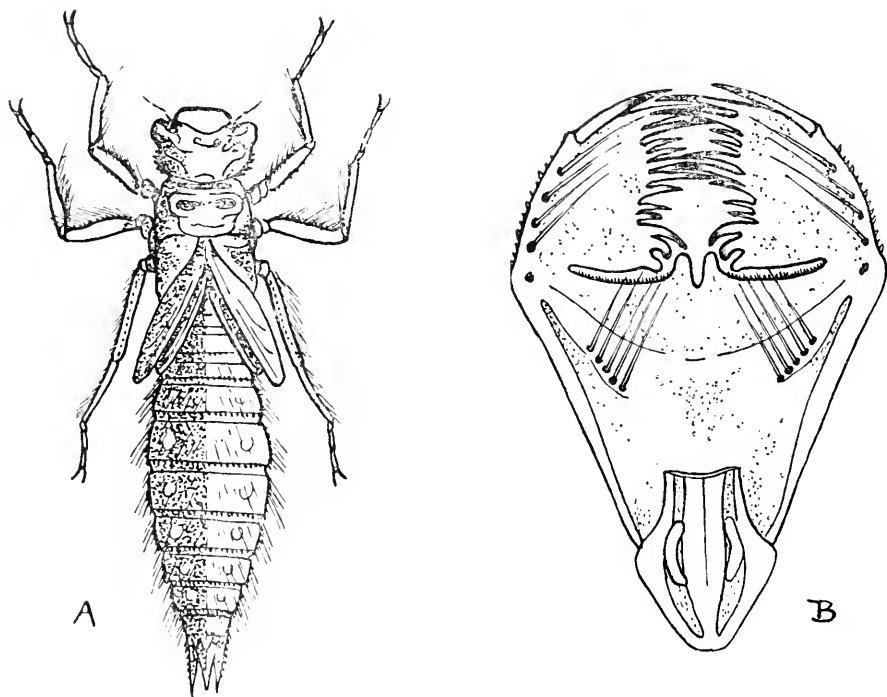


Fig. 1 A. Exuvia of *Orogomphus atkinsoni*, Selys. ($\times 2.3$).
B. Mask of same.

DESCRIPTION OF A NEW LIBELLULINE (*Palæothemis tillyardi*)
FROM BURMA.

PALÆOTHEMIS, gen. nov.

Head moderately large; eyes broadly contiguous; frons slightly rounded, foreborder correspondingly prominent; suture narrow and deep; vesicle high, notched above and with a small tubercle on either side.

Prothorax with a moderately large simple rounded posterior lobe furnished sparsely with hairs on its posterior border.

Thorax narrow. Legs long and robust, those of male with the hind femora naked except for a few long hairs and a single long spine at the distal end, mid femora with a row of 7 to 8 gradually lengthening spines and a longer distal one. Female with similar spines but fewer in number on the mid femora. Tibial spines long and moderately numerous. Claw-hooks situated about the middle of claws, robust.

Abdomen rather short, slim, dilated basally, triquetral and tapering gradually to a point.

Genitalia. Those on second abdominal segment of male (Fig. 2) very prominent; lamina broad and depressed; external hamules broad and rounded, internal short, robust, backwardly directed hooks; lobe elongate narrow, the end curving forwards. Female with the 8th abdominal segment not dilated; the vulvar scale small narrow and tongue-like, notched deeply in the middle.

Anal appendages of male as long as the 9th segment, cylindrical in rather more than the basal half, then abruptly tumid, almost clubbed, with a minute point at the apex. Inferior appendage shorter triangular, curving slightly up at the apex.

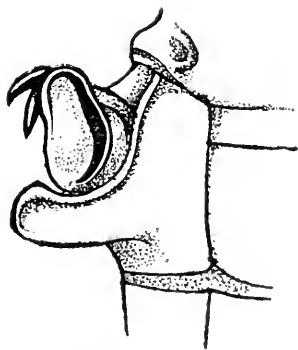


Fig. 2. Genitalia of *Paltothemis lillyardi* seen from the side.

Wings (Figure 3) very narrow, especially at the base, that of the hind actually narrower than the forewing, the apices broadly rounded, reticulation rather open, trigones in both wings with strongly bent costal side, bent at the middle in forewing, well distal in the hind, the trigones in line with one another; are between the 2nd and 3rd antennodals; sectors of arc stalked rather longly especially in the hindwing. Cu_1 and Cu_2 usually joined at the lower angle of trigone in hindwing but occasionally slightly separated; trigone in

hindwing slightly distal to the arc ; nodal index : males $\frac{9-12}{10-9} \left| \frac{11-8}{9-9}, \frac{9-12}{9-10} \right| \frac{12-9}{10-8}$
 $\frac{8-12}{8-9} \left| \frac{12-8}{10-8}$, females $\frac{9-12}{6-10} \left| \frac{10-8}{9-6}, \frac{9-12}{9-10} \right| \frac{12-10}{10-8}$, the final antenodal complete ; only
 1 row of cells between *Rs* and *Rspl*, the latter poorly developed ; cubital
 nervures 3 to 4 in number in all wings (occasionally 5 in some forewings) ; the
 position of the base of subtrigone very variable so that the subtrigone itself is
 also very variable in size and shape ; all trigones entire ; hypertrigones tra-
 versed once in the forewings of male, twice in those of female, usually entire
 but occasionally traversed once in the hind ; a single row of cells in discoidal
 field as far as node, dilated thereafter ; *Cu*₁ in forewing nearly flat and
 straight throughout ; supplementary nervures to the bridge in all wings ; loop
 entirely absent, the base of the hindwing being as narrow or more so than
 that of forewing ; stigma rather large ; membrane absent.

Concerning the genus *Dr. Tillyard*, who has examined the single species
 named after him, has kindly sent me the following notes :—

“ It runs very close to *Hypothemis*, a Fijian genus. Compared with
Hypothemis it shows the following differences of venation :—

- (i) The number of postnodals in both wings is greater and hence the
 nodus lies, by comparison, considerably closer to the base of
 the wing.
- (ii) The first two postnodals in both wings are incomplete (one only
 in each wing of *Hypothemis* is incomplete).
- (iii) The supratriangle (hypertrigone) of both wings is crossed (free in
Hypothemis).
- (iv) In both wings, *Cu*₁ arises very close to posterior angle of triangle,
 (in *Hypothemis* it arises well up along the distal side of the
 triangle).
- (v) The base of the hindwing is distinctly narrower than in *Hypothemis*.

“ As against these differences must be taken into account the very close
 resemblance shown to *Hypothemis* in other important characters, especially
 the position and number of the cubital cross-veins in both wings, and the
 absence of any enclosed loop in the anal field of the hindwings. This last
 character justifies its separation from *Tetrathemis* at once. Most species of
Tetrathemis have the supra-angle crossed as in the new genus (*Palaothemis*),
 yet one occasionally comes across a specimen with one or more supratriangles
 free.”

It must be noted that *Dr. Tillyard's* observations have been made on
 a single male specimen which I sent to him and that further observations made

on a number of other specimens reveals the fact that the hypertrigones in the hindwings are as often as not entire as in *Hypothemis*, those of the forewings are however invariably traversed, sometimes twice so, especially in the female. Also Cu_1 in the hindwing, nearly always arises from the posterior angle of the trigone, Cu_1 and Cu_2 arising from a single point. Only very occasionally does Cu_1 arise slightly separated from the posterior angle so that this is a very definite point separating the genus from *Hypothemis*. *Palæothemis* may be considered as even more primitive than *Hypothemis* and is probably now the most primitive Libelluline known.

Palæothemis tillyardi, spec. nov.

Several males and females from King Island, Mergui, Burma, collected by J. Elton Bott, September 1921.

Male. Abdomen 19 mm. Hindwing 22 mm.

Head. Eyes reddish brown above, changing to yellow beneath; labium, labrum, epistome and face opaque white; frons above and in front narrow and the vesicle metallic green; occiput black.

Prothorax pale brown.

Thorax black in front and on dorsum, marked on either side with an irregular antehumeral stripe of bright yellow which extends upwards for about halfway to the antealar sinus, and below narrows abruptly extending as far down as the mid coxæ. Laterally bright citron yellow marked by two stripes of dark brown, the anterior at the level of the spiracle, rather diffuse and limited below by the spiracle, the posterior very fine, outlining the posterolateral suture.

Tergum bright vermilion red.

Legs black, the mid and anterior pair of femora striped with bright yellow on the inner side. Coxæ and trochanters yellow.

Wings hyaline, stigma blackish brown, over $2\frac{1}{2}$ cells, braced. Bases of wings slightly saffronated.

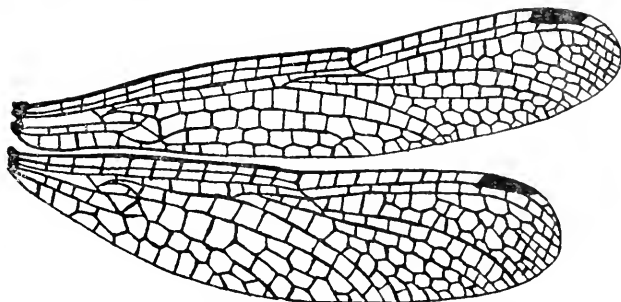


Fig. 3. Wings of *Palæothemis tillyardi*. ♂ ($\times 4.0$).

Abdomen bright vermilion red, segmental sutures and the ventro-dorsal border narrowly black ; segments 5 and 6 with the red encroached upon by the black, which is present as a broad band laterally and apically, and a finer line on the middorsal carina thus enclosing two quadrate spots of red ; on segment 7, the red reduced to a small subdorsal basal spot, whilst segments 8 to 10 are entirely black.

Segments 1 to 4 beneath bright yellow. Anal appendages black.

Female. Abdomen 17 mm. Hindwing 21.5 mm.

Head. Eyes pale brownish yellow ; labium and labrum black the latter narrowly white at the base, lateral palps white ; epistome opaque white ; vesicle and frons as in male but greenish metallic.

Prothorax and thorax bright citron yellow marked with a broad dark brown humeral stripe and similar lateral stripes as in male. Tergum yellow.

Legs similar to those of male but hind femora also marked with yellow on inner side. Wings as for male.

Abdomen similarly marked as in male but the ground colour yellow instead of red.

Habitat. Taken amongst rubber on King Island, Mergui. From the number of specimens received, the insect must be locally common. As for its habits, they must be somewhat similar to those of *Tetrathemis* and it will not be out of place here to make a few observations on the latter genus. My observations have been made on *Tetrathemis platyptera* which, as would be expected in such archaic insects, are found in the wildest retreats. They breed in deep pools or tanks at an altitude varying from 1,000 to 3,000 ft. As a rule they prefer a deep pool in the course of a mountain stream. The rivers may dry up but the pools remain and *Tetrathemis* breeding therein never strays far from its precincts when once it has emerged from the nymph.

Mr. T. N. Hearsey has found this insect breeding in wells in Palghat and I myself know of a solitary jungle pool in the Nilgiris where it has been apparently breeding for years. The males perch themselves on prominent twigs overhanging or sticking out of the water at the edge of the pools. When disturbed they rise perpendicularly into the air, hover for a time, the wings whirring rapidly and then descend in the same manner to resume their former perch. If alarmed they ascend straight up into the air to a great height and take cover in the trees overhead. Their flight is strikingly like that of *Rhino-cypha*, a significant fact when one considers the Zygopterous character of their wings.

Type (male) in the Pusa collection. Cotypes (male and female) in Pusa and Fraser collections.

PUBLICATIONS OF THE IMPERIAL DEPARTMENT OF AGRICULTURE IN INDIA

TO BE HAD FROM

THE OFFICE OF THE AGRICULTURAL ADVISER TO THE GOVERNMENT OF INDIA, PUSA, BIHAR,
and from the following Agents :—

- | | |
|---|--|
| (1) THACKER, SPINK & CO., CALCUTTA. | (7) THACKER & CO., LTD., BOMBAY. |
| (2) W. NEWMAN & CO., CALCUTTA. | (8) SUNDER PANDURANG, BOMBAY. |
| (3) RAI M. C. SARKAR BAHADUR &
SONS, CALCUTTA. | (9) RAI SAHIB M. GULAB SINGH &
SONS, LAHORE. |
| (4) HIGGINBOTHAMS, LTD., MADRAS. | (10) MANAGER, EDUCATIONAL BOOK
DEPÔT, NAGPUR. |
| (5) THOMPSON & CO., MADRAS. | |
| (6) D. B. TARAPOREVALA, SONS &
CO., BOMBAY. | |

A complete list of the publications of the Imperial Department of Agriculture in India can be obtained on application from the Agricultural Adviser to the Government of India, Pusa, Bihar, or from any of the above-mentioned Agents.

These publications are :—

1. *The Agricultural Journal of India*. A Journal dealing with subjects connected with agricultural economics, field and garden crops, economic plants and fruits, soils, manures, methods of cultivation, irrigation, climatic conditions, insect pests, fungus diseases, co-operative credit, agricultural cattle, farm implements, and other agricultural matters in India. Illustrations, including coloured plates, form a prominent feature of the Journal. It is edited by the Agricultural Adviser to the Government of India, and is issued once every two months or six times a year. *Annual Subscription*, Rs. 6 or 9s. 6d., including postage. Single copy, R. 1-8 or 2s.
2. Scientific Reports of the Agricultural Research Institute, Pusa.
3. Annual Review of Agricultural Operations in India.
4. Proceedings of the Board of Agriculture in India.
5. Proceedings of Sectional Meetings of the Board of Agriculture.
6. Memoirs of the Imperial Department of Agriculture in India :
 - (a) Botanical Series.
 - (b) Chemical Series.
 - (c) Entomological Series.
 - (d) Bacteriological Series.
 - (e) Veterinary Series.
7. Bulletins issued by the Agricultural Research Institute, Pusa.
8. Indigo Publications.
9. Books.

The following are the publications of the last two years :—

Scientific Reports of the Agricultural Research Institute, Pusa (including the Reports of the Imperial Dairy Expert and Secretary, Sugar Bureau), for the year 1920-21. Price, R. 1-8.

Scientific Reports of the Agricultural Research Institute, Pusa (including the Reports of the Imperial Dairy Expert and Secretary, Sugar Bureau), for the year 1921-22. Price, As. 14.

AGRICULTURAL PUBLICATIONS—(concl'd.)

- Review of Agricultural Operations in India, 1920-21. Price, R. 1-4.
 Review of Agricultural Operations in India, 1921-22. Price, R. 1-4.
 Proceedings of the Board of Agriculture in India, held at Pusa on the 13th February, 1922, and following days (with appendices). Price, R. 1.
 Proceedings of the Third Meeting of Mycological Workers in India, held at Pusa on the 7th February, 1921, and following days. Price, As 11.
 Proceedings of the Second Meeting of Agricultural Chemists and Bacteriologists, held at Pusa on 7th February, 1921, and following days. Price, As. 10.
 Report of the Proceedings of the Fourth Entomological Meeting, held at Pusa, 7th to 12th February, 1921. Price, Rs. 7-8. (*Out of print.*)

MEMOIRS OF THE DEPARTMENT OF AGRICULTURE IN INDIA

BOTANICAL SERIES

- Vol. XI, No. IV. Studies in Gujarat Cottons, Part I, by MAGANLAL L. PATEL, B.Ag. Price, Rs. 2 or 2s. 6d.
 Vol. XI, No. V. Die-back of Chillies (*Capsicum* spp.) in Bihar, by JEHangIR FARDUNJI DASTUR, M.Sc. Price, R. 1 or 1s. 4d.
 Vol. XI, No. VI. The Influence of Atmospheric Conditions upon the Germination of Indian Barley, by W. YOUNGMAN, B.Sc. Price, As. 9 or 1s.
 Vol. XI, No. VII. Correlation of Colour Characters in Rice, by G. P. HECTOR, M.A., B.Sc. Price, R. 1-4 or 1s. 8d.
 Vol. XI, No. VIII. The Inheritance of Characters in Rice, II, by F. R. PARNELL, M.A., Ag. Dip. (Cantab.), with the assistance of G. N. RANGASWAMI AYYANGAR, B.A., K. RAMIAH, L.Ag., and C. R. SRINIVASA AYYANGAR, L.Ag. Price, R. 1-4 or 1s. 8d.
 Vol. XI, No. IX. A New Ginger Disease in Godavari District, by S. SUNDARAKAMAN, M.A. Price, R. 1 or 1s. 4d.
 Vol. XI, No. X. *Helminthosporium* spp. on Cereals and Sugarcane in India, Part I. (Diseases of *Zea Mays* and *Sorghum vulgare* caused by species of *Helminthosporium*), by M. MITRA, M.Sc. Price, R. 1 or 1s. 4d.
 Vol. XII, No. I. The Wheats of Bihar and Orissa, by ALBERT HOWARD, C.LE., M.A.; GABRIELLE L. C. HOWARD, M.A.; and ABDUR RAHMAN KHAN. Price, As. 8 or 9d.

CHEMICAL SERIES

- Vol. V, No. IX. The Retention of Soluble Phosphates in Calcareous and Non-calcareous Soils, by W. H. HARRISON, D.Sc., and SURENDRA LAL DAS, M.Sc. Price, R. 1 or 1s. 4d.
 Vol. V, No. X. Windrowing Sugarcane in the North-West Frontier Province. Part I. The Effect on the Economical and Agricultural Situation, by W. ROBERTSON BROWN. Part II. The Effect on the Composition of Sugarcane, by W. H. HARRISON, D.Sc., and P. B. SANYAL, M.Sc. Price, As. 12 or 1s.
 Vol. VI, No. I. Investigations on Indian Opium. No. 1. Non-environmental Factors influencing the Alkaloidal Content and Yield of Latex from the Opium Poppy (*Papaver somniferum*), by HAROLD E. ANNETT, D.Sc. (Lond.), F.I.C., M.S.E.A.C., HARI DAS SEN, M.Sc., and HAR DAYAL SINGH, B.Sc. Price, R. 1-8 or 2s.
 Vol. VI, No. II. Investigations on Indian Opium. No. 2. The Effect of Non-environmental Factors on the Alkaloidal Content and Yield of Latex from the Opium Poppy (*Papaver somniferum*) and the bearing of the work on the functions of Alkaloids in Plant Life, by HAROLD E. ANNETT, D.Sc. (Lond.), F.I.C., M.S.E.A.C. Price, Rs. 2 or 2s. 9d.
 Vol. VI, No. III. Studies in Soil Moisture, Part I, by B. H. WILSDON, B.A. (Oxon.), I.E.S. Price, R. 1-8 or 2s.
 Vol. VI, Nos. IV & V. Variations in some Characteristics of the Fat of Buffalo and Cow Milk with changes in Season and Feeding; The Mutual Applicability of the Analytical Figures for Butter, Fat and Ghee, by F. J. PLYMEN, A.C.G.I., and A. R. PADMANABHA AYYER, B.A. Price, As. 12 or 1s. 3d.
 Vol. VI, No. VI. Investigations on Indian Opium. No. 3. Studies in the Meconic Acid Content of Indian Opium, by HAROLD E. ANNETT, D.Sc. (Lond.), F.I.C., M.S.E.A.C., and MATHURA NATH BOSE, M.A. Price, As. 6 or 6d.
 Vol. VI, No. VII. Chemical Studies on Safflower Seed and its Germination, by V. A. Tamhane, M.Sc., M. Ag. (*In the press.*)
 Vol. VI, No. VIII. Note on the Permanent Manurial Plots, Coimbatore, by ROLAND V. NORRIS, D.Sc. (*In the press.*)
 Vol. VII, No. I. A Note on Hydrocyanic Acid in the Burma Bean (*Phaseolus lunatus*, sp.), by P. J. WARTH, M.Sc., B.Sc. Price, As. 12 or 1s.

ENTOMOLOGICAL SERIES

- Vol. VII, Nos. IV & V. New Indian Gall Midges (Hemiptera), by E. P. FELT; Three New Wasps from India, by G. R. DUTT, B.A. Price, As. 12 or 1s.
- Vol. VII, No. VI. Life histories of Indian Insects. Diptera: *Sphyracephala heuracana*, Westw., by S. K. SEN, B.Sc. Price, As. 12 or 1s.
- Vol. VII, Nos. VII & VIII. New and Rare Indian Odonata in the Pusa Collection; Further notes on Rhinocypha Larvae, by MAJOR F. C. FRASER, F.M.S. Price, R. 1-4 or 1s. 9d.
- Vol. VII, No. IX. Notes on Indian Diptera, by RONALD SENIOR-WHITE, F.E.S. Price, R. 1-12 or 2s. 3d.
- Vol. VII, No. X. *Platyedra gossypiella*, Saund., Pink Boll worm in South India, 1920-21, by E. BALLARD, B.A., F.E.S. (In the press.)
- Vol. VII, No. XI. Studies in Indian Dermaptera, by MORGAN HUBARD. Price, R. 1-4 or 1s. 9d.
- Vol. VII, No. XII. Further Notes on *Pemphorus affinis*, Fst. (The Cotton Stem Weevil), by E. BALLARD, B.A., F.E.S. (In the press.)
- Vol. VII, No. XIII. An Account of Experiments on the Control of *Siga* (*Schanobius*) *inertellus* in the Godavari Delta, by E. BALLARD, B.A., F.E.S. (In the press.)
- Vol. VIII, Nos. I, II & III. *Hydrophilidae* of India, by A. D'ORCHY-MONT; An Annotated List of Ichneumonidae in the Pusa Collection, by G. R. DUTT, B.A.; A. Second Note on Odonata in the Pusa Collection, by MAJOR F. C. FRASER. Price, R. 1 or 1s. 6d.

VETERINARY SERIES

- Vol. III, No. II. The Virulence of Tubercle Bacilli isolated from Bovine Lesions in India, by A. L. SHEATHER, B.Sc., M.R.C.V.S. Price, R. 1-4 or 1s. 8d.
- Vol. III, No. III. Bovine Lymphangitis, by A. L. SHEATHER, B.Sc., M.R.C.V.S. Price, R. 1-8 or 2s.
- Vol. III, No. IV. Studies in Rinderpest, by W. A. POOL, M.R.C.V.S., and T. M. DOYLE, F.R.C.V.S. Price, R. 1 or 1s. 4d.
- Vol. III, No. V. Etiology of Equine Contagious Abortion in India, by T. M. DOYLE, F.R.C.V.S. Price, As. 8 or 9d.

BULLETINS ISSUED BY THE AGRICULTURAL RESEARCH INSTITUTE, PUSA

- No. 100. Annotated List of Indian Crop-Pests, by T. BAINBRIDGE FLETCHER, B.Sc., F.E.S., F.Z.S. Price, R. 1-8.
- No. 101. Some Insects recently noted as Injurious in South India, by T. V. RAMAKRISHNA AYYAR, B.A., F.E.S., F.Z.S. Price, As. 8.
- No. 102. Borers in Sugarcane, Rice, etc., by T. BAINBRIDGE FLETCHER, B.Sc., F.E.S., F.Z.S., and C. C. GHOSH, B.A. Price, R. 1.
- No. 103. Some Indian Economic Aleyrodidae, by C. S. MISRA, B.A. Price, As. 8.
- No. 104. The Rice Leaf-hoppers, by C. S. MISRA, B.A. Price, As. 6.
- No. 105. Cotton Boll-worms in India, by T. BAINBRIDGE FLETCHER, B.Sc., F.E.S., F.Z.S., and C. S. MISRA, B.A. Price, As. 8.
- No. 106. The Pink Boll-worm in Egypt, by LEWIS H. GOUGH, Ph.D., F.E.S. Price, R. 1.
- No. 107. Experiments in Egypt on the Survival of the Pink Boll-worms (resting stage larvae) in Ripe Damaged Cotton Bolls buried at different depths, by F. C. WILLCOCKS. Price, As. 5.
- No. 108. Some Pests of Cotton in North Bihar, by C. S. MISRA, B.A. Price, As. 6.
- No. 109. *Tukra* Disease of Mulberry, by C. S. MISRA, B.A. Price, As. 4.
- No. 110. The Preservation of Wood against Termites, by T. BAINBRIDGE FLETCHER, B.Sc., F.E.S., F.Z.S., and C. C. GHOSH, B.A. Price, As. 3.
- No. 111. Stored Grain Pests, by T. BAINBRIDGE FLETCHER, B.Sc., F.E.S., F.Z.S., and C. C. GHOSH, B.A. Price, As. 14.
- No. 112. Notes on Rearing Insects in Hot Climates, by T. BAINBRIDGE FLETCHER, B.Sc., F.E.S., F.Z.S., and C. C. GHOSH, B.A. Price, As. 7.
- No. 113. Hints on Collecting and Preserving Insects, by T. BAINBRIDGE FLETCHER, B.Sc., F.E.S., F.Z.S. Price, As. 10.
- No. 114. The Preparation and Reproduction of Scientific Illustrations, by A. W. SLATER. Price, As. 4.
- No. 115. Note on Plant Imports into India, by T. BAINBRIDGE FLETCHER, B.Sc., F.E.S., F.Z.S. Price, As. 7.
- No. 116. A Survey of the Indian Poppy-growing Districts for Morphine Content of Opium produced, by H. E. ANNETT, D.Sc. (Lond.), F.L.C., M.S.E.A.C., HARI DAS SEN, M.Sc., and HAR DAYAL SINGH, B.Sc. Price, As. 2.
- No. 117. Experiments with Castor Seed Conducted at Sabour, by C. SOMERS TAYLOR, B.A. Price, As. 3.
- No. 118. The Saving of Irrigation Water in Wheat Growing, by ALBERT HOWARD, C.E., M.A., and GABRIELLE L. C. HOWARD, M.A. Price, As. 4.
- No. 119. The Agricultural Development of Baluchistan, by ALBERT HOWARD, C.E., M.A., and GABRIELLE L. C. HOWARD, M.A. Price, As. 6.

BULLETINS ISSUED BY THE AGRICULTURAL RESEARCH INSTITUTE, PUSA—(concl'd.)

- No. 120. The Serum Simultaneous Method of Inoculation against Rinderpest, by W. A. POOL, M.R.C.V.S. Price, As. 2.
- No. 121. Notes on Contagious Abortion in Pony and Donkey Mares, by R. BRANFORD, M.R.C.V.S., and T. M. DOYLE, F.R.C.V.S. Price, As. 5.
- No. 122. Pusa 12 and Pusa 4 in the Central Circle of the United Provinces, by B. C. BURT, M.B.E., B.Sc., F.C.S., ALBERT HOWARD, C.I.E., M.A., and GABRIELLE L. C. HOWARD, M.A. Price, As. 11.
- No. 123. The Bundelkhand Cottons. Experiments in their Improvement by pure Line Selection, by B. C. BURT, M.B.E., B.Sc., F.C.S., and NIZAMUDDIN HAIDAR. Price, As. 4.
- No. 124. Safflower Oil by ALBERT HOWARD, C.I.E., M.A., and J. STEWART REMINGTON. Price, As. 4.
- No. 125. The Weevil Fauna of South India with special reference to Species of Economic Importance, by T. V. RAMAKRISHNA AYYAR, B.A. F.E.S., F.Z.S. Price, R. 1-4.
- No. 126. Cawnpore-American Cotton, II. Further Field Trials (1918-20), Spinning Trials and Market Organization, by B. C. BURT, M.B.E., B.Sc. Price, As. 4.
- No. 127. Coconut Bleeding Disease, by S. SUNDARARAMAN, M.A. Price, As. 8.
- No. 128. *Helminthosporium* Disease of Rice, by S. SUNDARARAMAN, M.A. Price, As. 9.
- No. 129. The Preparation of Anti-rinderpest Serum using Animals of moderate susceptibility as Virus Producers, Part I. Buffaloes, by W. A. POOL, M.R.C.V.S., and T. M. DOYLE, F.R.C.V.S. Price, As. 12.
- No. 130. Feeding Experiments at Government Cattle Farm, Hissar, by R. BRANFORD, M.R.C.V.S., and E. SEWELL, M.C., M.R.C.V.S. Price, As. 3.
- No. 131. An Entomologist's Crop Pest Calendar for the Madras Presidency, by T. V. RAMAKRISHNA AYYAR, B.A. F.E.S., F.Z.S. Price, As. 2.
- No. 132. Report of Campaign against *Spodoptera mauritia*, Boisdu. (*Noctuidæ*) in Malabar, by E. BALLARD, B.A., F.E.S. Price, As. 2.
- No. 133. Results of Investigation of Bionomics of *Platyedra gossypiella*, Saunders, in South India, together with some notes on *Earias insulana* and *E. fabia*, by E. BALLARD, B.A., F.E.S. Price, As. 5.
- No. 134. Supplementary Observations on Borers in Sugarcane, Rice, etc., by C. C. GHOSH, B.A. Price, As. 6.
- No. 135. Some Observations on the Control of Field Rats in the Punjab, by M. A. HUSSAIN, M.A., and HEM SINGH PRUTHI, M.Sc. Price, A. 1.
- No. 136. The Hydrogen Ion Concentrations of some Indian Soils and Plant Juices, by W. R. G. ATKINS, O.B.E., Sc.D., F.I.C. Price, As. 4.
- No. 137. Note on the Probability of an Inter-relation between the Length of the Stigma and that of the Fibre in some forms of the genus *Gossypium*, by RAM PRASAD. Price, As. 4.
- No. 138. Methods of Examination of certain Characters in Cotton, by G. R. HILSON, B.Sc. Price, As. 8.
- No. 139. List of Publications on Indian Entomology, 1920-21 (compiled by the Imperial Entomologist). Price, R. 1.
- No. 140. The Determination of Prussic Acid in Burma Beans (*Phaseolus lunatus*). (Preliminary Note), by J. CHARLTON, B.Sc. Price As. 3.
- No. 141. Comparative Manual Value of the whole Plants and the different parts of Green Manures, by N. V. JOSHI, B.A., M.Sc., L. Ag. Price, As. 6.
- No. 142. The Cultivation of Lac in the Plains of India, By C. S. MISRA, B.A. (*In the press.*)

INDIGO PUBLICATIONS

- No. 9. The Nature of the Changes occurring during the Extraction of Indigo from the Java Plant (*Indigofera arrecta*), by W. A. DAVIS, B.Sc., A.C.G.I. Price, R. 1.
- No. 10. Note on the Deterioration of Indigo Seed during Storing, by MAJOR W. R. G. ATKINS, Sc.D., F.I.C. Price, As. 3.
- No. 11. The Nature of changes occurring in the Indigo Steeping Vat, II, by W. A. DAVIS, B.Sc., A.C.G.I. Price, R. 1-10.

BOOKS

- Wheat in India, by ALBERT HOWARD, M.A., A.R.C.S., F.L.S., and GABRIELLE L. C. HOWARD, M.A. 288 pp. Price, Rs. 5 or 7s. 6d.
- A Description of the Imperial Bacteriological Laboratory, Muktesar: Its Work and Products, by MAJOR J. D. E. HOLMES, M.A., D.Sc., M.R.C.V.S. Price, As. 8 or 9d.
- Agriculture in India, by JAMES MACKENNA, M.A., I.C.S. Price, As. 4 or 5d.
- Some Diseases of Cattle in India. A Handbook for Stock-owners. Price, As. 8 or 9d.
- The Importance of Bacterial Action in Indigo Manufacture, by C. M. HUTCHINSON, B.A. Price, As. 2 or 3d.
- Report on the Diseases of Silkworms in India, by A. PRINGLE JAMESON, D.Sc. Price, Rs. 3-

